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ABSTRACT

This pamphlet represents the third in a six-part series describing the Management Organization Systems Technique (MOST), developed at Wayne County Community College, whose purpose is to determine the goals and objectives of a college and to assist in their attainment and evaluation. The information sub-system is designed to collect, process and feed back historical and projected data on finance, facilities, enrollments, staffing, and faculty, administrative and student performance, to provide relevant information for planning and decision-making. The requirements of the input and output components of the system include timeliness, accuracy, cost effectiveness, and relevance. System implementation takes place in five stages: (1) a feasibility study; (2) design of the system to meet specific college needs; (3) physical preparation of equipment and materials; (4) design of the necessary forms and data collection instruments; and (5) development of a procedures manual. The information system is applicable to clerical record-keeping functions, institutional finance, and, most importantly, to strategic planning. The design of the data base, relative to data collection, processing, and output in the form of management reports, is based upon the educational objectives of the institution. (AYC)

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A Management System for Higher Education

The Information System

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WAYNE COUNTY COMMUNITY COLLEGE

MANAGEMENT ORGANIZATION SYSTEMS TECHNIQUE

DEVELOPMENTAL TEAM

Reginald Wilson, Ph D., President

Mostafa M. Afr, Ph D., Vice President for Finance

Milan M. Chonich, MBA.
Director, Budget & Management Development

Carmen J. Pascaretti, MBA.
Program Budget Evaluation Systems Coordinator

Steven M. Racine, MBA.
Management Systems Coordinator

Dr. Frederick W. Bertolaet, Associate Dean
School of Education
University of Michigan
Consultant

INTRODUCTION TO
MANAGEMENT ORGANIZATION SYSTEMS TECHNIQUE

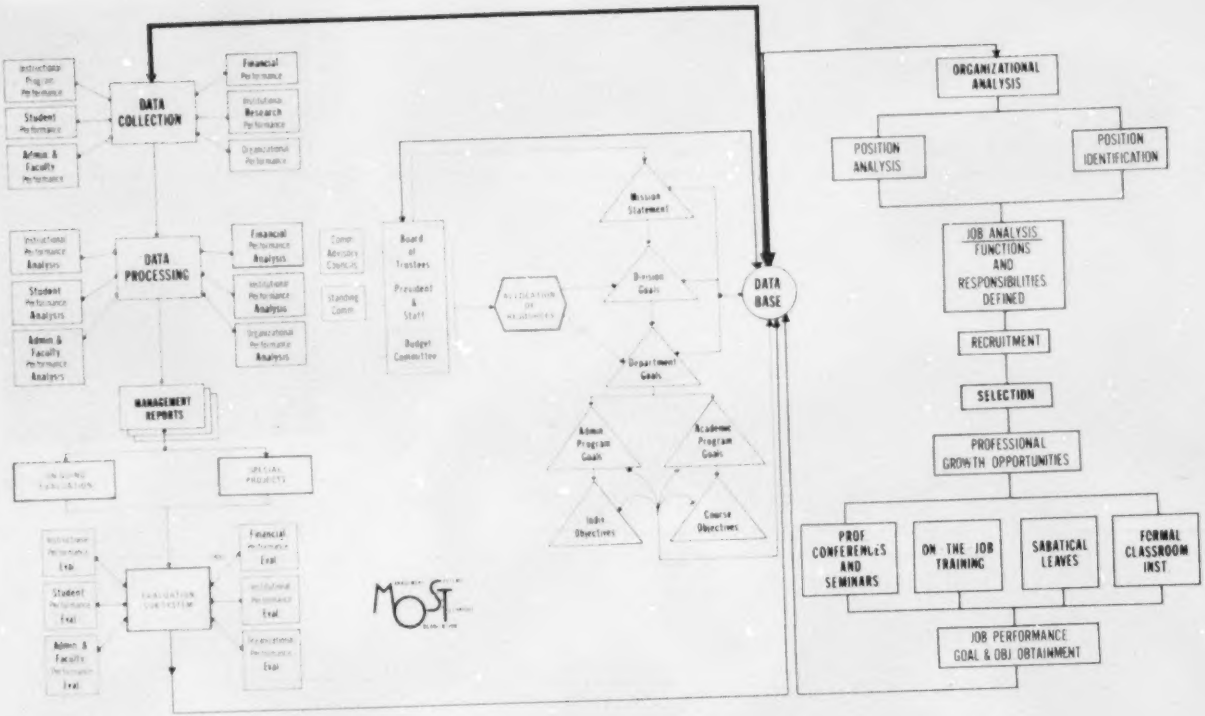
One of the finest achievements during my tenure as chief executive officer of Wayne County Community College has been the recent development within its professional ranks of a comprehensive management program entitled, "Management Organization Systems Technique" (M.O.S.T.).

A prototypical concept in 1971, M.O.S.T. has evolved into a profound far-reaching system which is expected to provide the College's leadership with an excellent opportunity for coordinating the dynamic growth and development of the College, thereby being able to respond quickly and efficiently to the College's needs.

Under the direction of the Board of Trustees, the Vice Presidents and I have strongly supported and encouraged the efforts of the developmental team headed by Dr. Mostafa M. Afr, Vice President for Finance. That team has brought to fruition a comprehensive program yielding educational and service benefits to students, faculty, staff members and the community we have been entrusted to serve.

The five year development of M.O.S.T. has been worthwhile. Through the effective implementation of this management system in the months and years to come, we will be able to meet our responsibilities well, in addition to helping create for the community at large a community college truly responsive to its community's needs.

Dr. Reginald Wilson
President


DATA COLLECTION
Financial Performance
Institutional Research Performance
Organizational Performance
Instructional Program Performance
Student Performance
Admin. & Faculty Performance
DATA PROCESSING
Financial Performance Analysis
Institutional Performance Analysis
Organizational Performance Analysis
Instructional Performance Analysis
Student Performance Analysis
Admin & Faculty Performance Analysis
MANAGEMENT REPORTS
Board of Trustees
President & Staff
Budget Committee
Comm. Advisory Councils
Standing Comm.
DATA BASE
Mission Statement
Division Goals
Department Goals
Admin Program Goals
Academic Program Goals
Indiv Objectives
Course Objectives
MOST
ORGANIZATIONAL ANALYSIS
POSITION ANALYSIS
POSITION IDENTIFICATION
JOB ANALYSIS FUNCTIONS AND RESPONSIBILITIES DEFINED
RECRUITMENT
SELECTION
PROFESSIONAL GROWTH OPPORTUNITIES
PROF CONFERENCES AND SEMINARS
ON THE JOB TRAINING
SABATICAL LEAVES
FORMAL CLASSROOM INST
JOB PERFORMANCE GOAL & OBJ OBTAINMENT

INTRODUCTION

As educational institutions have increased in size or complexity, their need for a reliable system of providing information has also increased. Until recently, the concept of creating a system to collect relevant information, process it, and disseminate it to appropriate decision makers has not been considered a high priority in the field of education. Although some institutions, motivated by the growing complexity of their organizations, developed piecemeal data systems to satisfy particular needs, these systems often tended to be uncoordinated efforts that failed to provide some management areas with needed data while various subsystems produced identical sets of information for individual managers.

Undoubtedly many educational institutions perceived a need for a comprehensive data system for management but chose not to develop such a system because of the cost and magnitude of the task, both of which seemed to outweigh the urgency. In addition, many institutions did not have on their managerial staffs a sophisticated systems planner who could oversee the development of a comprehensive system.

A system can be defined as "an array of components designed to accomplish a particular objective according to plan."[1] Thus, an education information system can be thought of as a combination of data inputs, files, procedures, hardware, software, and outputs which, when assembled correctly, can aid in the operation and planning activities of a college or university.

If an information system is being utilized to its maximum capability, its major function will be to aid management in decision-making situations. The system may also expedite operational functions by aiding in clerical and record-keeping tasks. But it is a mistake to focus the information system on mere summaries of operational data. A fully-utilized system will provide information for planning by developing historical and projected data on finances, facilities, enrollments, staffing, and the organization and will include information on interrelationships and interdependencies.

It is the intent of the M.O.S.T. information subsystem to provide necessary and relevant information on a timely basis to planners and decision

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[1] Johnson, Kast and Rosenzweig, *The Theory and Management of Systems* (New York: McGraw Hill, 1967), p. 113.

makers. The system as a whole is structured upon creating those processes that will lead to optimal decisions. The information sub-system is designed to ensure this optimality.

COMPONENTS

Input

The input for an information system is raw data, which, after processing, becomes useful information. The primary source of data for an education information system tends to be student-centered – enrollment figures, grading reports, housing information, and data concerning graduation and financial aid. The second major data source is operational information, such as material and equipment purchase records, payroll information, recruitment files, and miscellaneous financial data. The final source is the informational requirements of the system itself. These include the policies and objectives of the college and its various departments, long and short term plans, teaching methods utilized, and the many constraints placed on the college from outside agencies or environments.

Raw data inputs are converted into information by means of a processor. Although most of the work of the processor is performed by the computer, special reports developed from the information generated are best handled by an individual assigned to this function since attempting to program this step through the computer would attach an undue expense to the system.

Output

Obviously, the output of the information system must correlate highly with the output of the institution. For the most part, institutional output consists of graduates, research, and public service of various types. Thus a management decision regarding proposed expansion of a particular instructional program will be based on information that covers past, present, and projected enrollment trends in this field of study; the costs of expansion in terms of equipment, renovation, and manpower; and the availability of space. At the same time the decision must take into account the goals of the institution and the objectives of the instructional area which offers the program.

The desired output of the system will determine its inputs. This means that the design of the system will be fashioned by the informational require-

ments of management since the key objective of an education information system is to provide management with accurate information at the time it is needed. However, aiding the decision-making process is not the only objective of the system. It should also help to control it.

> The achievement of a single output at a point in time is not sufficient for a continuing system. The system must continue to perform according to the objectives and planned performance levels. Deviations beyond allowable tolerances must be detected and corrected quickly and effectively. This can be done by a feedback mechanism, which is an essential part of the control function – the comparison of actual with desired performance and the initiation of appropriate corrective action.[2]

An effective system will provide information to management personnel in regard to the outcomes of their decisions. It will point out the false assumptions that may have been made and other factors that may have resulted in poor performance. In addition, the system will maintain a record of institutional goals and objectives, match this information with actual output, and report the variances and possible future courses of action to the appropriate managers.

REQUIREMENTS

Timeliness

Although the required speed for output will depend on the type of decision needed, timeliness is an essential factor in an information system. Accounting records may require information only on a monthly basis. If so, a computer batching approach, which provides for the processing of similar data in a relatively long run, may be the most cost-efficient manner of generating information.

Registration information, on the other hand, is needed immediately to advise students when a class has filled. On-line registration procedures allow a clerk to verify that a class is open, enroll a student, and then update the file to include the additional student. Since on-line processing at registration requires tying up a computer, providing remote-site access, and adding terminal operators, the procedure becomes an added cost. Further, because this method is designed for speed, there is little time for checking the input, treatment, or output. As a consequence, costly inaccuracies can occur.

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[2]Khateeb M. Hussain, *Development of Information Systems for Education* (Englewood Cliffs, N.J.: Prentice Hall, 1973), p. 64.

Between the two extremes of batching and on-line input and output, there are several other possibilities such as on-line input with delayed output, mixed on-line and batched input, or mixed computer and human processing. Since a decrease in time generally implies increased costs and inaccuracies, the speed of processing required of the system should reflect the actual need for the information at that time.

Accuracy

The need for precise accuracy varies with the purpose for which the information will be used. Payroll information requires near-perfect accuracy. Supply inventories need not be as exact and can be corrected periodically by an actual physical count.

The chief source of error is inaccuracy in input. Source data may be incorrect, transcoded improperly, or keypunched incorrectly. Error can also come from improperly followed procedures or poor processing methods. The least likely cause of inaccuracy ought to be equipment failure since a modern computer should have less than one failure in every 100 hours of running time, which equates to once in every 35 billion instructions.

Costs

Of course, with an unlimited budget that would provide extensive back-up systems, almost any level of accuracy or timeliness is possible. The constraining factor is cost, and costs are likely to increase considerably if sought-after improvements involve both manpower and equipment, which is usually the case when attempting to strengthen input organization, transcription, communications, procedures and processing, detecting errors, or correcting errors. If anticipated benefits are quantifiable, a cost-benefit determination can be made. However, when the benefits are not known, keeping costs to a minimum is probably the best approach. One must keep in mind also that there are hidden costs associated with moving to a new system. These include installation costs, maintenance, training – including lost employee time, updating service fees, and the cost of establishing control and clerical procedures.

Relevance

Russell Ackoff maintains that one fallacy concerning information systems is that managers have a lack of relevant information. He contends that the problem is rather an overabundance of irrelevant information. Khateeb M. Hussain makes a

similar point when he states:

> Information that is 'nice to have' but not necessary should be avoided. Information that is unrefined, and hence not useable as well as obsolete information can be a liability for it obscures important information.[3]

Although some information may appear to be relevant, it could still be unnecessary for arriving at a particular decision. For example, if a university student is under consideration for admission to an Honors Program in his junior year, information concerning his high school grades will probably not be necessary to make the decision since fresher information is available from his performance in his first two years at the university. Providing managers with "complete" information for every problem can needlessly slow the decision-making process. The function of a system should be to provide better, more relevant data to those concerned and to provide it more quickly. W. J. Crowley points out the problem with complete information when he states:

> I do visualize total integrated systems that will collect, digest and deliver decision-inspiring data to management, but only that which can be generated from the flow of activities carried on by the firm's own employees . . . I do not visualize total integrated systems that will synthesize for management decision purposes all the facts relating to ambient political, economic, and other factors that the management would like to have at its fingertips in order to remove all hazards from business projections and decisions.[4]

IMPLEMENTATION

Feasibility

A feasibility study is generally prompted by the recognition of a need for a system change. This need may come from changes in " . . . goals or objectives; organizational structure or personnel; availability of resources; environment or technology."[5] Both costs and organizational constraints must be examined as part of the study. Among the common organizational constraints are administrative resistance to the proposed change, lack of qualified personnel, and resistance to new organizational structures designed to facilitate information flow. Constraints can also include technological or timing factors.

The feasibility study may suggest that several mutually exclusive systems would prove useful. In

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[3]Hussain, *op. cit.*, p. 93.

[4]W. J. Crowley, "Can We Integrate Systems Without Integrating Management?" *The Computer Sampler*, edited by James Boore and Jerry Murphy (Ney York: McGraw-Hill, 1968), p. 269.

[5]Hussain, *op. cit.*, p. 197.

making a choice among potential systems, management should consider first the financial resources required. There will be initial costs as well as recurring costs for areas such as maintenance and personnel. Secondly, management should examine the anticipated consequence of each system, inasmuch as a system may cause structural or procedural changes. Next, the benefits and limitations of the various systems should be listed. Finally, a schedule for implementation should be developed since time could be a determining factor.

The requirements of the system consist of the information objectives set for it by management, along with those policies and constraints within which it must function. Management, at this stage, declares what the system should provide rather than how it should provide it.

> There is a great danger of forgetting, or at least neglecting, the significance of criteria-selection. If extreme care is not exercised in this part of the task, all the researcher's ingenuity and scientific tools may be wasted in deriving right answers to the wrong questions -- which are sometimes diametrically wrong answers to the real questions.[6]

Within this process, not only must the type of information required be specified but also the accuracy, timeliness, completeness, input needs, back-up systems, security measures and estimated resources essential to these requirements.

Design

The first phase in the design of the system once the objectives have been set and the type of system determined is to develop an overall system plan. This may include the integration of many systems changes or the complete development of a comprehensive information package. In either case, it is necessary that operational and hardware specifications be developed prior to any attempt at implementation. These specifications will state boundaries for speed, error rate, maintenance, cost and other hardware and software capabilities.

It has already been indicated that it is necessary to know the output requirements before the input specifications can be finalized. After the output objectives have been determined, it is still necessary to outline the content and format specifications for the output. The questions to be asked in regard to the required output of the system beyond the stated objectives for its use in decision making are:

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[6] Ronald McKean, "Sub-Optimization Criteria and Operations Research," *Organizational Decision-Making* (Englewood Cliffs, N.J.: Prentice Hall, 1967), p. 165.

> Is the output readable: does it have an adequate, unique and meaningful title, are the different types of reports easily accessible, are the pages identified, are all the abbreviations and codes used in the output adequately identified, are the assumptions identified, is the period for which the data is relevant identified, is the output dated, in cases of runs on the same date, is the run number identified, is the output complete, is it accurate, is the output easy to store and retrieve?[7]

The input necessary to achieve the output objectives in the format required must be ascertained. It is usually wise to develop an input-output grid which shows the various input needs for each report to be generated as output. This procedure will highlight the interrelationships between the various reports so that efficiency in aggregating the data can be achieved. Raw data can then be collected at the lowest level of aggregation needed for the various outputs since it is much easier to summarize the data for other needs than to attempt to disaggregate already summarized date.

Control and feedback procedures must also be built into the system design. The control function has two aspects: internal and external. Internal control consists of the matching process between expected system results and actual achievement. Thus, the system is designed to test itself and to bring the results of the tests to the relevant managers. Externally, since most public colleges and universities must be audited by either state or private auditors, the system must be created in a way that facilitates what is known as an "audit trail." Starting at any point in the cycle of input processing and output, the auditor should be able to follow the progress of an individual transact backward or forward.

Developing control and feedback processes involves additional costs. In the case of auditing ease, the cost is probably necessary. But again, management must decide whether the marginal benefits derived from additional control are worth the marginal costs.

The system specifications that are developed in the last stage of design are the programming requirements. The managers utilizing the information have little involvement in this process. Although the work is technical, management should ensure that the programming is consistent and allows interchangeability between individual programmers. Management must also ensure that the programming properly matches the input and output specifications determined prior to this stage.

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[7] Hussain, *op. cit.*, p. 257.

Preparation of System

The final implementation phase involves the actual physical preparation of the system. Among the tasks of this phase are equipment selection or conversion, form design and procedural or activity changes. Equipment selection is a technical task involving many separate decisions. The costs of computer resources are very high and the benefits can be great; therefore, much care should be taken to match current and projected needs with the proper type of equipment.

Form Design

Form design is an art as well as a science. Most often, the output requirements will determine the data that should appear on the input forms. Below is a checklist for analyzing input form design.

1. Are the instructions for completing the form adequate and easily understood?
2. Is the code (if used to complete form wholly or partially) identified so that errors can be traced?
3. Is there sufficient space for completing information without crowding?
4. Are the questions worded unambiguously?
5. Are the questions in proper sequence to avoid confusion?
6. Are lines to be filled in by typewriting spaced to conform to typewriter spacing?
7. Is the vertical alignment on forms to be typewritten such that clerks can use the typewriter tabulator-stop device?
8. Does the form provide larger spaces for handwritten data than typewritten data?
9. If the form is to take information from or pass information to another form, does it show items in the same order as the other?
10. Does the form have all recurring items printed so that only variable values need to be filled in?
11. Is all known information preprinted?
12. Have all fact-gathering data been included?
13. Have the data been so arranged that backtracking is unnecessary?
14. Is the form designed so that no information is lost when the form is filed or bound?

15. Is the form printed on the size and weight of paper that meets the requirements of the form without being more expensive than necessary?[8]

Procedures

Procedures provide the link between what tasks must be performed and who will perform them. A procedure,

> . . . . tells how to do the job, what processes to use, and other general information about the job. The procedure is task-oriented; it normally is written as a formal document segmenting the tasks to be performed. The primary purpose of the procedure is instructional in nature. It is not designed or intended to represent job flow except with the task covered, or to relate the task at hand with those preceding or following.[9]

The procedures manual is a necessary component of any information system. It should specify the tasks required, data to be supplied, and responsibilities of each position within the operation. This allows for the tasks performed to be a rational outgrowth of the objectives to be achieved. In developing the manual, several guidelines should be followed. These include making the manual personnel-independent, assigning jobs to individuals based on their responsibility and authority, avoiding monotony, allowing for job enrichment, specifying boundaries of responsibility, standardizing similar tasks, and allowing for feedback and evaluation. Most importantly, it should be updated continually to ensure that the objectives of the institution still require the specified procedures.

APPLICATION

There are three major applications of an information system. They have been defined as follows:

1. Operational control is the process of assuring that specific tasks are carried out effectively and efficiently.
2. Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.
3. Strategic planning is the process of deciding on objectives of the organization, on changes in

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[8]Randolph and Burgly, *Systems and Procedures for Business Data Processing* (Cincinnati: Southwestern Publishing Corporation, 1968), pp. 235-36.

[9]R. A. Johnson, *et al, The Theory and Management of Systems* (New York: McGraw-Hill, 1967), p. 116.

these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use and disposition of these resources.[10]

The operations aspects of information systems are probably the most widely used since they are the easiest to develop. They embrace the information required for the clerical function of the college. Computerization of the payroll, registration, student records and many other strictly clerical tasks have greatly increased the operational efficiency of colleges and has allowed the maintenance of detailed files in even the largest university.

Control aspects of the information system generally connote financial control. Computerization has allowed the development of program budgeting in colleges. This technique provides a line item, cost-center breakdown of budgets and expenditures and, through this information, a more careful control of resources. Besides financial control, advanced information systems also include statistical analysis, variance analysis techniques, and model-building for inventory or facility control as well as costing models.

The most significant function of the information system is to provide decision-makers with sufficient data for analyzing alternatives and determining solutions to problems. For several years, the concept of planning by budgeting has dominated the thinking of academic managers, but since the arrival of advanced information systems in education, the long-range simulation model has begun to replace budgeting as the formeost planning technique.

> The modern college or university requires a planning process that will specify alternative ways of reaching the determined objectives, establish the cost of each alternative and measure its benefits and determine which of the alternative plans the institution should undertake . . . A simulation model is a mathematical description of the interrelationships of the major functions and processes which occur within the various organizational entities of an institution. A model enables the administrators to quickly and precisely test the effect of change in key factors of university operation on an overall institutional performance.[11]

Providing decision makers with the information relevant to each problem cannot be done if computer systems alone are used. Many special prob-

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[10]Robert N. Anthony, *Planning and Control Systems* (Cambridge, Mass.: Harvard University Press, 1965), p. 16.

[11]Leo L. Kornfeld, Robert G. Farris and David N. Olson, "Simulation Models: Technique for Juggling the What Ifs," *Journal of Education Data Processing,* Vol. 53 (November, 1972), 31-7.

lems requiring a wide range of information in unique output format will be beyond the scope of computer programming, at least at any reasonable cost. Thus, one should not assume that an information system necessarily implies complete reliance upon the computer. It must be remembered that, prior to the development of the computer, every organization maintained manual systems and that today, even the most sophisticated institution relies on human processing for much of its input and certain special output requirements.

FALLACIES IN CURRENT THINKING

Russell Ackoff has warned management against developing what he terms "Management Misinformation Systems." He claims that certain false assumptions made by management doom the information system to failure. Ackoff's first false assumption, that managers lack relevant information, has been discussed in the section *"Relevance."* Because the real problem is the overabundance of information, two important functions of the system become filtration and condensation. Ackoff concludes that one of the major stages of designing the system is for managers to be certain of the information they require.

The second fallacious assumption is that managers need the information they want. According to Ackoff, "One cannot specify what information is required for decision making until an explanatory model of the decision process and the system involved has been constructed and tested."[12] He contends that a typical manager will ask for all information available in the mistaken belief that it will aid him in decision making. The third fallacy, therefore, is that the quality of decision making necessarily improves with more information.

The last assumption that Ackoff claims will cause dysfunctional system design is that the manager does not have to understand how the system works, only how to use it. If one employs this assumption, then the users of the system cannot evaluate it. Thus, Ackoff emphasizes that the measurement criterion of the information system is not the quantity of information provided, but rather the effect information has on planning and control within the institution.

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[12] Russell Ackoff, "Management Misinformation Systems," *Management Science*, 26 (December, 1967), p. 46.

17

GOAL OF INFORMATION SYSTEMS

The goal of any information system is to provide decision makers with a foundation from which to make optimal choices between alternatives. Further the system should provide feedback in order to measure success or failure. It was to achieve these goals that the information system of M.O.S.T. was developed.

Management Organization Systems Technique (M.O.S.T.) is designed to create and integrate the processes and procedures required of a sophisticated management system for educational administration. M.O.S.T. requires college management to take previously unrelated resources, facilities, skills, and other components and arrange them into a system that will attain the goals of the college. The information system of M.O.S.T. primarily attempts to gather and process those data required to provide relevant timely and accurate information to the college management. Further, the system should lend itself to the production and storage of the transactional files necessary for the efficient clerical and record-keeping functions of any organization.

M.O.S.T. DATA BASE SUBSYSTEM

A planning subsystem, of course, cannot function without "usable" information. Although planning and decision making are the focus of M.O.S.T., a system for collecting, processing and feeding back data in the form of relevant information is essential. Planning cannot begin without the injection of large amounts of data, and it cannot be final until a device for measuring the success of planning is installed. The data and evaluation subsystems jointly form this device. Also, the creation of these systems yields assistance in the planning process. Data which are used in formats for decision making can also be used to aid the college in clerical functions.

An information system is an organized method of providing past, present, and projected information related to internal operations and external reporting. It supports the three major functions of college administration – planning, control, and operation. The design of the system is based upon the documented management requirements of information to be used for the decision-making activities of the college.

Although most modern information systems are presumed to require computer assistance, the concept of M.O.S.T. is applicable to electronic data processing or manual processing. Actually, the functions of both are similar. Both require personnel, data input and organization, data storage and processing, and information output. The differences arise in modes of processing and storage. As might be expected, a computer-based system has certain advantages over a manual-based design. The most obvious are speed and size of manipulative files. Another important advantage is the accuracy of the computer when dealing with large amounts of data or mathematical analysis. For special reporting purposes, a manual system is often the most efficient since detailed computer programming is needed to produce a non-repetitive form or report. Most data systems, therefore, utilize both manual and computer-assisted collection and processing techniques.

The most essential function of the M.O.S.T. data subsystem is to provide management with the information it needs to assist it in decision making. Thus, beyond mere data collection, the information system must process the raw data, summarizing, categorizing, and in fact, filtering it so that the decision makers not only possess the relevant information, but further, are not overburdened with so much data that they are no longer effective. The other major function of the M.O.S.T. data subsystem is to provide low cost, accurate and efficient processing and storage of operational data.

DATA COLLECTION

Procedures for planning and information generation will not join adequately if the organization is not comprised of competent, motivated individuals. Disregarding altruism, it is in the interests of the college to spend time and money on recruitment and then to set objectives concerning development of the staff. Research has shown that motivated personnel perform better than others. If a management system is to maximize its utility, it must ensure the maximum utilization of personnel. It is for these, as well as altruistic reasons, that a primary concern of M.O.S.T. is a policy of intelligent staffing and staff development.

There are two ways that the information system affects college planning. The first is to provide input into the initial planning phases when relevant information is required. The second is to provide

feedback through the reporting of actual performance. When performance is measured against initial expectations, the data system is said to be performing a control function.

In creating the information system, the M.O.S.T. program bases the data-input specifications upon the required output. That is, the uppermost criterion for the design of the system is a knowledge of what decisions are to be made by the college. It is from this foundation that the information system builds. Subsequent to ascertaining the types of decisions to be made, research is done to determine how they are made; how often; what other institutional areas they affect; what factors are most important in making them; and the sequential timing of the decisions. From this research, the benefits to be derived from providing an informational process to assist in each type of decision can be estimated. Continuing this research should produce:

1. The organization's key success variable,
2. Its objectives,
3. The breakdown of specific tasks,
4. The characteristics of information requirements of different sub-processes of management,
5. The specific information requirements for functions and individuals,
6. The benefits of influencing the decision-making process,
7. Alternative systems to satisfy requirements, and,
8. Finally, the costs of the different systems.[13]

Once these factors are determined, an information strategy can be developed that maximizes the difference between benefits and costs. The kinds of information required and the systems best suited for their delivery should be an outcome of this process.

Feedback to the planning system is essential if decision making is to become truly systematized. The control function of the data base in M.O.S.T. is provided by its aggregation of measurable objectives as set in the planning subsystem and the

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13Deardon, John; McFarlan, F.Warren; Zani, William M.; ***Managing Computer-Based Information Systems,*** (Homewood, Ill.: Richard D. Irwin, 1971).

subsequent actual results in terms of the performance indicators corresponding to each objective. This information, when analyzed, summarized and reported back to management allows for rational evaluation of college performance. Thus, not only does M.O.S.T. supply the information required for decision making, it also monitors the system and reports on its outcomes.

The data input necessary to expedite college operations is facilitated greatly through computer assistance. The operations or transactions data usually refer to payroll, purchasing records, student admissions, enrollment, and personnel files. The clerical tasks involved in maintaining and manipulating files demanding so much data become quite overwhelming as the size of the institution increases. Cost and efficiency factors have forced nearly all medium-size and large colleges to computerize most of their transaction files. This computerization results in high speed, accurate processing of large amounts of data, the storage of much of the data for future reference, and the ability to recall select pieces of information for special analysis. When mathematical processing of large amounts of data is required, the computer yields output virtually free of error.

To provide the input required for processing, input forms and procedures are developed in accordance with the output they will generate. The procedures manual is a vital document in the M.O.S.T. Program. It specifies those tasks which must be performed in order for departmental objectives to be met. In this respect, it can again be noted that the central focus of M.O.S.T. is the planning of decision-making function. Procedures are based upon the objectives to be achieved and reflect those tasks determined to be most efficient for this achievement. The procedures are personnel independent so that employee changes do not radically affect departmental performance.

Forms are also designed to aid the information generation function. They are the base documents from which raw data are transferred into the system. Vigorous study of the data inputs required will produce a matrix showing the needs of the various departments. From this matrix a determination of the most efficient method for collecting the inputs is made. Forms are then designed to minimize the number of separate data generating documents. Standardizations of form structure reduces confusion and, it is hoped, clerical errors as well.

DATA PROCESSING

The processing of data involves the manipulation of files from one or more input sources to produce information in usable form. Typically, this processing involves sorting, summarizing, subtotaling and totaling, performing mathematical functions, and printing reports in a format that facilitates understanding and highlights the relevant information. Although M.O.S.T. and be utilized by manual or computer-assisted systems in a medium to large size college, it is considerably more efficient to use a combination of both processing methods. Many operational functions, such as payroll and registration, are especially adaptable to the computer. On the other hand, special planning or control reports that do not recur on a regular basis are often most efficiently processed by using manual techniques.

The output produced through data processing, although user-oriented, requires systems specialists for designing purposes. Whether manual or electronic, the efficient processing of large amounts of critical data must be thoroughly planned. Reports generated from the processing stage should satisfy specific information requirements of management. It is important that the information system be centered in one office so that the sizable job of data coordination and control can be completed.

Any information system cannot function without three necessary resources: (1) hardware, (2) software, and (3) personnel. Processing hardware varies greatly depending upon the sophistication of the system. A large university will find it profitable to invest in a complete computer operation, the initial cost of which can approach several million dollars. The hardware comprising this operation will include the processing unit itself as well as input and output devices, batteries of memory files, remote terminals, and printers. A small college will need very little hardware. Its processing requirements may be met with several clerks using adding machines. Slightly larger institutions may find it necessary to purchase time from a computer broker, saving on the expense of owning and operating a computer facility.

Without the proper software, even the most sophisticated hardware becomes useless equipment. The development of procedures and processes is a specialized one, demanding the time and talent of many individuals. For example, developing the ledgers, files, procedures, summary reports and other related activities needed to rationalize the

accounting system demands the talents of a specialist. Likewise, developing the processes required to computerize the accounting function may be even more difficult although the output and input are the same. To create a data base which allows the different users of the system to access those particular files required for specific reports may take a large staff several years.

No matter what the level of computer utilization, the processing of data will involve some manual aid. In M.O.S.T., many types of reports are generated strictly by hand. Architectural or innovative institutional proposals are two instances requiring little or no computer assistance, but a great deal of sophistication.

The M.O.S.T. processing subsystem, along with the data-collection function, is oriented toward the output it provides. The most essential phase of the information system is its product, evaluation and control. This product is considered a separate subsystem of M.O.S.T. and will be discussed separately. Just as the planning phase of M.O.S.T. is considered output-oriented, one can speak of the information system as also being geared toward the output it produces.

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*This publication is third in a series being planned to delineate other salient features of M.O.S.T.

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Wayne County Community College
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